Global Burden of Animals Diseases - case study:
The burden of animal diseases in UK pork production

Beat Thomann[1,2], Ben Huntington[2], Gemma Chaters[2], William Gilbert[2], Heiko Nathues[3], Jonathan Rushton[2]

[1]Veterinary Public Health Institute, Vetsuisse Faculty, University of Bern, Switzerland;
[2]Department of Livestock and One Health, Institute of Infection, University of Liverpool, United Kingdom;
[3]Clinic for Swine, Vetsuisse Faculty, University of Bern, Switzerland
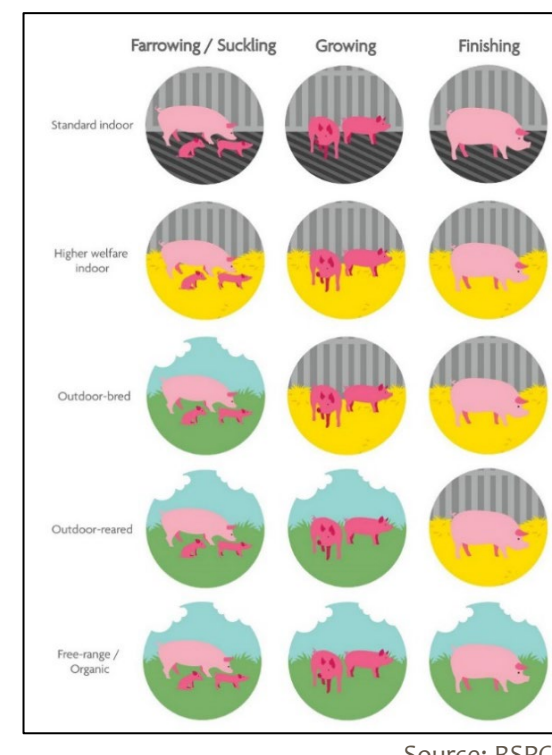
Introduction

Objectives:

» Classification of the UK pork production systems
» Estimation of the biomass and capital investment
» Level of inputs and outputs in each system
» Estimation of the animal health loss envelope

Definition of "disease burden" within GBADs framework:

» Notifiable/transboundary diseases
» Endemic and non-communicable diseases
» Nutritional issues
» Injuries and accidents
» Poor animal husbandry practices

→ Removal of disease = ideal health

» The ideal health scenario is free from all possible causes of disease burden.

Common rearing systems in the UK:

Source: RSPCA

Common pork labels in the UK:

Data availability

Availability of detailed performance data:

» Breeding herds indoor
» Breeding herds outdoor
» Rearing (7-35kg)
» Finishing (35-110kg)
» Combined rearing-finishing (7-110kg)

UK pork production systems are very diverse

» Multiple rearing systems
» Multiple pork labels
» Farms often comprise more than one production stage
» General data availability is high
» However, the availability of more granular data is limited to only a few production types

Production systems and demographics:

Demographics:
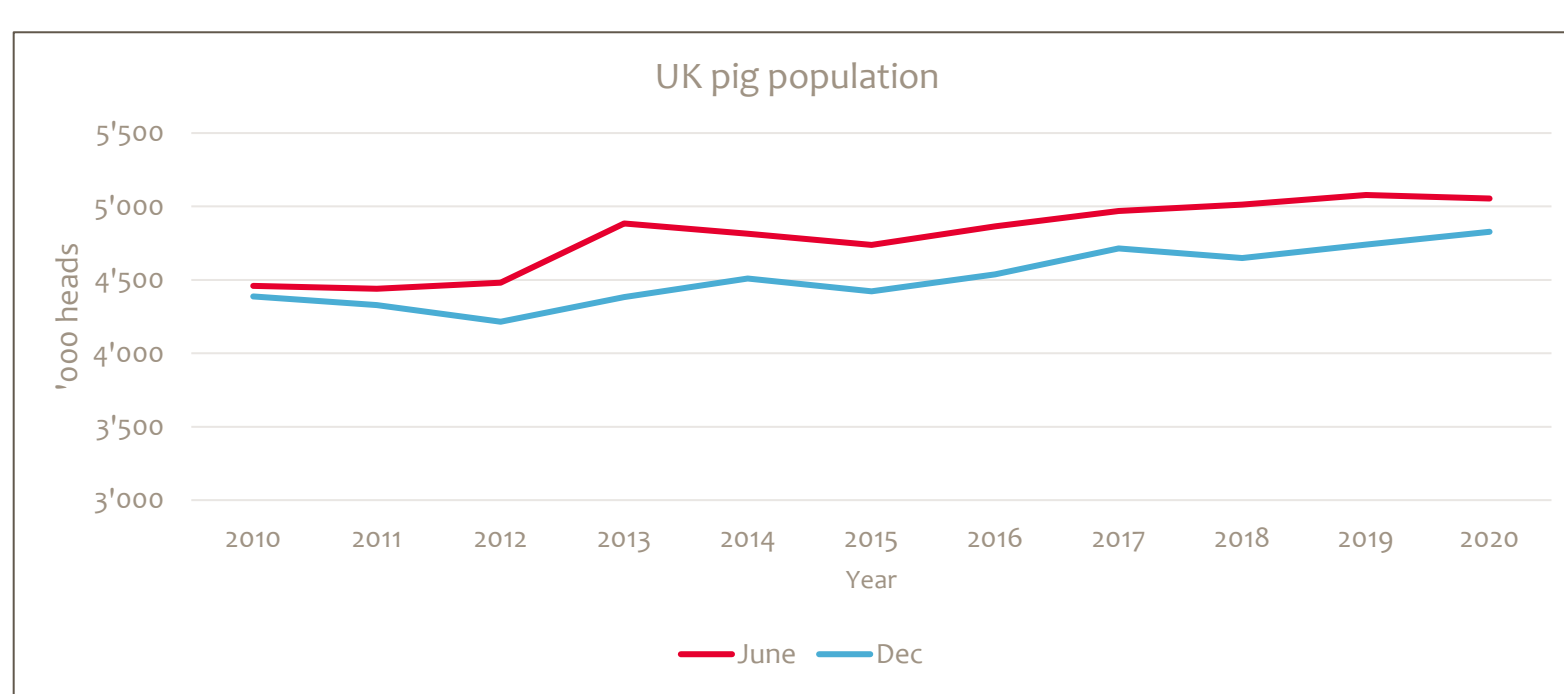
Variation in the UK pig population size over the last 10 years. Source: DEFRA

» Dynamic pig population size, variation between and within years
» In December 5% fewer pigs than in June (2020)
» From 2010 to 2020, the population increased by 594,000 heads (+13.3%)
» December survey data (DEFRA) includes detailed numbers for different weight categories in fattening pigs
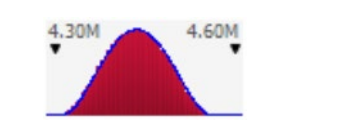» Fattening pigs accounted for 90% of the pig population and breeding pigs for 10% (2020).

Biomass:

$$Biomass\ (kg) = N * W$$

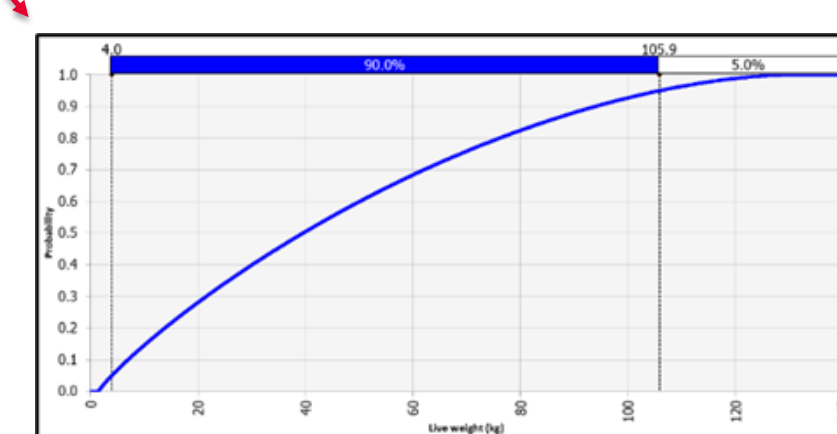| Parameter	Value
Minimum	4,323,663
Most likely	4,438,409
Maximum	4,553,155
Chart	

Values of the PERT distribution for the fattening pig population size used as input variable.


Probability distribution of the live weight of fattening pigs.

Biomass, as a measure for comparison between species and populations, is a dynamic figure because of the fluctuation in number of animals as well as the weights of the pigs, especially fattening pigs (estimates reported as medians)

» Breeding population: 98,692 t
» Fattening pig population: 175,091 t
» UK pig population: 273,949 t

Capital value:

Source: AHDB, Defra, IHS Maritime & Trade – Global Trade Atlas®/HMRC, LAA, IAAS
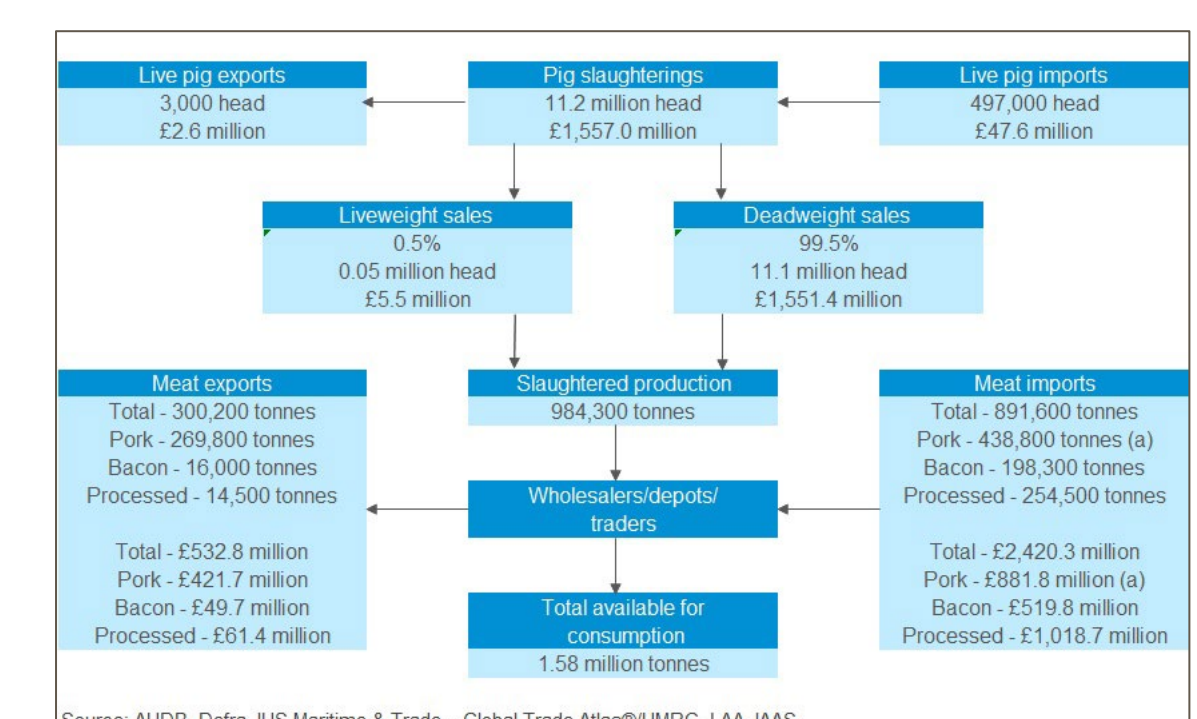
Estimation of capital value of UK pig population, based on population and market data:

» Fattening pigs: £308 million
» Breeding pigs: £73 million
» The mean capital value of the entire UK pig population was estimated at £381 million.

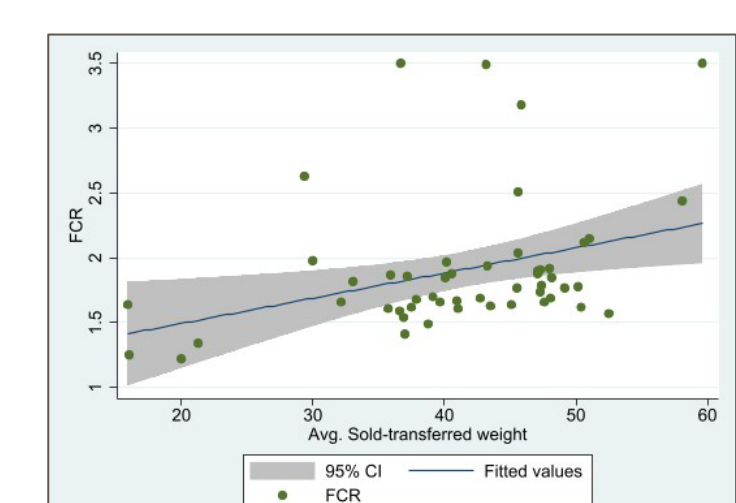## Animal Health Loss Envelope

Methods:
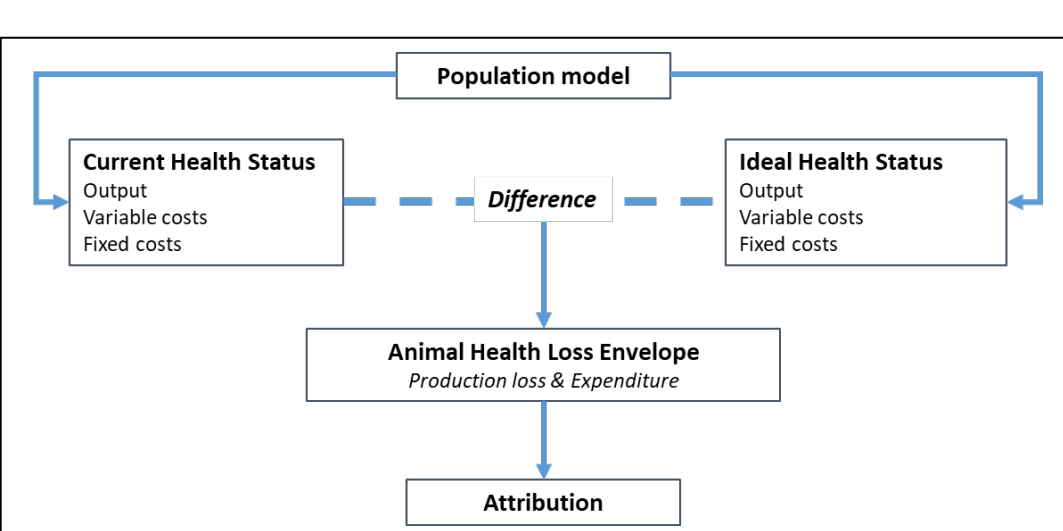
	AHLE		
Scenario:	"Average"	"Top10"	"Ideal"
Disease level	standard	low	absent
Performance level	average	high	maximum

Stage	Size		
Breeding	250[1]	500	1,000
Rearing	1,000[2]	2,500	5,000
Fattening	1,000[3]	2,000	5,000

[1]working sows, [2]nursery spaces, [3]fattening spaces

Selected input variables for the three different scenarios (Average, Top10, Ideal) used for the model to estimate the AHLE for the breeding stage.

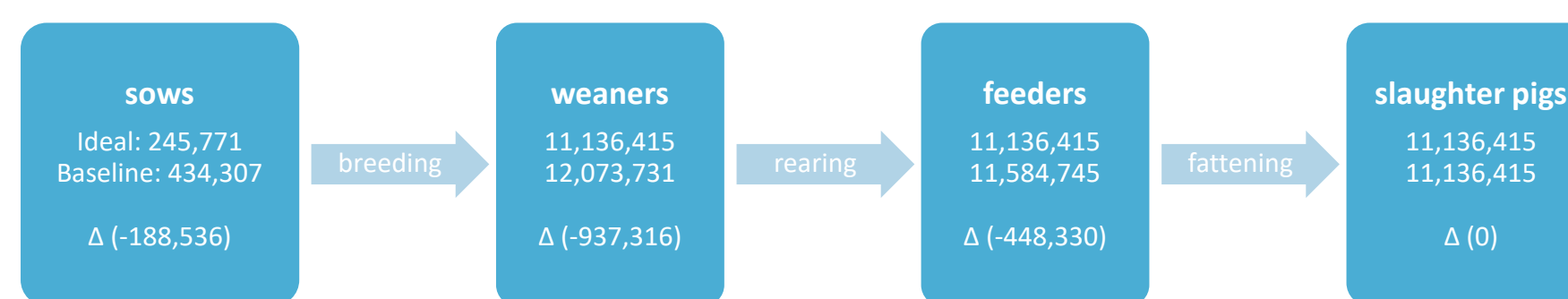| BREEDING STAGE	Average (diseased)	Top10 (diseased)	Ideal (without disease)
Production rhythm (weeks)	3	3	3
Length of suckling period (weeks)	3	3	3
Replacement rate per year (%)	54	53	50
Return-to-oestrus rate (%)	14.5	8.8	0
Sow mortality (%)	8.3	7.4	0
Abortion rate (%)	2.9	1.8	0
Average piglets born alive per sow per litter	14.3	15.8	17.4*
Pre-weaning mortality (%)	12.3	9.5	0
Weight at weaning (kg)	7.3	6.9	7.3
Litters/sow/year	2.21	2.34	2.61*
Pigs weaned per sow per year	27.8	33.6	45.3*

Linear regression to estimate the feed conversion ratio (FCR) for rearing pigs in the ideal scenario.

» Stochastic simulation model with different disease state and herd size scenarios

Input / Output:

sows	weaners	feeders	slaughter pigs
Ideal: 245,771	11,136,415	11,136,415	11,136,415
Baseline: 434,307	12,073,731	11,584,745	11,136,415
Δ (-188,536)	Δ (-937,316)	Δ (-448,330)	Δ (0)

Number of animals required per production stage to achieve the target values of pigs slaughtered per year. The top values refer to the utopia scenario, the middle values to the average production (baseline) and the bottom values to the difference between utopia and average production.
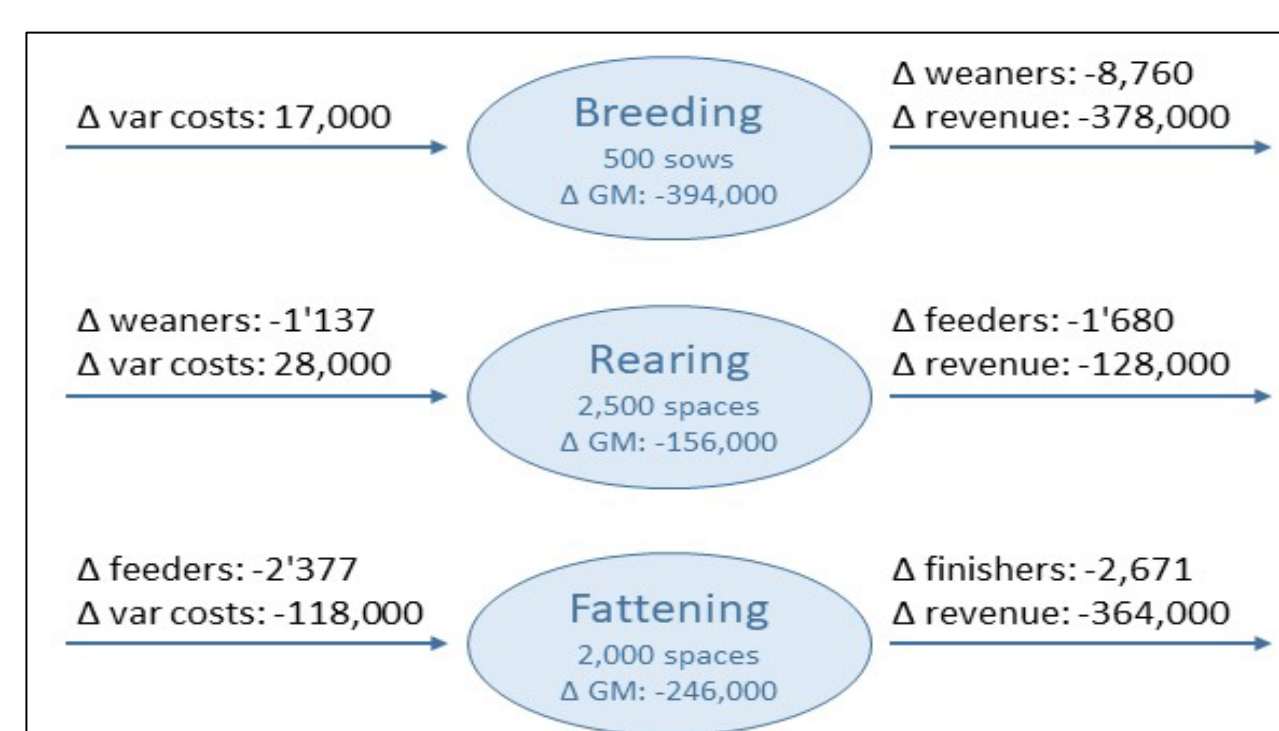
Differences of input and output (in number of animals and monetary values) between diseased and healthy production systems. Values (in £) are reported in the perspective of a diseased farm.

» Lower input (188,536 fewer sows, 937,316 fewer weaners and 448,330 fewer feeders) is required to reach the same output when disease is removed (ideal health)

AHLE:

» The Animal Health Loss Envelope for the UK pork production was estimated at £858million per year.

Estimates for the Animal Health Loss Envelope (AHLE) for the different production stages and on the population level for the total pig production in the UK (in £). Estimates are based on farm-level outcomes and average performance levels used as baseline.

Production stage	Number of farms	AHLE median	AHLE 5% percentile	AHLE 95% percentile
Breeding	869	342,600,078	337,034,341	350,100,221
Rearing	900	140,045,233	136,906,492	143,900,927
Fattening	1,523	374,947,195	366,912,266	385,410,123
TOTAL		857,592,506	840,853,099	879,411,272

Implications:

» Significant disease burden in the UK pork production:
  • Estimated annual AHLE (£858m) corresponds to 55% of the total annual value of pig slaughterings (£1,557m)
  • AHLE is 2.25 larger than the mean capital value of the entire UK pig population (£381m)
» Same output could be achieved with a substantially lower input
» Next steps GBADs analytical structure: Attribution of disease burden and impact across the wider economy
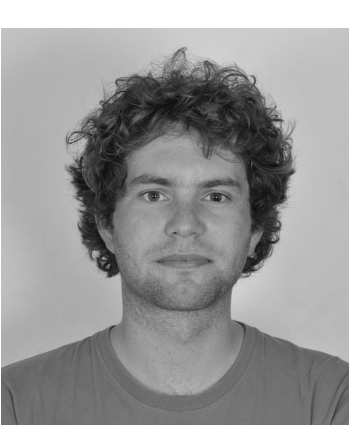
Beat Thomann, PhD MSc
University of Bern
Veterinary Public Health Institute
beat.thomann@unibe.ch
Tel +41 (0)31 631 57 35